Patent Claims

1. A transformer with forced liquid cooling, comprising:
- a core and upper and lower voltage windings, which are each associated with one another concentrically, and arranged in a sealed tank which is provided with an inlet and an outlet for a liquid coolant which flows through the interior of the tank, and
- guide surfaces which are used to guide the coolant being arranged between the inlet and the outlet such that the coolant flow has two or more flow areas which are arranged one behind the other in the flow direction, a first of which is associated with the windings, a second of which is associated with limbs of the core which surround the windings, and a third of which is associated with the other upper parts of the core and of the wall of the housing.

2. The transformer as claimed in claim 1, wherein in order to form the guide surfaces,
- two windings which are associated with one another concentrically are each arranged at a distance both from one another and from the core,
- the core, which is approximated in steps to a circular cross section, is provided with a binding in the area of the windings, forming channels,
- the inner of the two windings which are each associated with one another concentrically is arranged on the outside of a first mounting cylinder and the outer winding is arranged on the inside of a second mounting cylinder, with an annular gap being formed between the first mounting cylinder and the binding,
- the two windings have a first associated annular chamber on one end face, and have a second associated annular chamber on the other end face,

with
- the first annular chamber being connected to the coolant inlet,
- both annular chambers being provided with openings which lead into an intermediate space between the two windings,

- and the second chamber being adjacent to the core and being open towards the annular gap and towards the channels.

3. The transformer as claimed in claim 2, wherein rod-like spacers are arranged at locations where the core has chord-like discrepancies on a circular cross section in order to approximate the cross section of the core and the circumference of the binding.

4. The transformer as claimed in claim 2, wherein the second mounting cylinder is formed by a supporting binding.

5. A transformer with forced liquid cooling, comprising:

- a sealed coolant tank having an inlet and an outlet,
- a core, upper and lower voltage windings being associated with one another concentrically, and arranged in said sealed tank, and
- guide surfaces for guiding the coolant being arranged between the inlet and the outlet such that the coolant flow has at least two flow areas which are arranged one behind the other in the flow direction, a first of which is associated with the windings, a second of which is associated with limbs of the core which surround the windings.

6. The transformer as claimed in claim 5, wherein a third flow area is associated with the other upper parts of the core and of the wall of the housing.

7. The transformer as claimed in claim 5, wherein two windings which are associated with one another concentrically are each arranged at a distance both from one another and from the core.

8. The transformer as claimed in claim 5, wherein the core, which is approximated in steps to a circular cross section, is provided with a binding in the area of the windings, forming channels.

9. The transformer as claimed in claim 5, wherein the inner of the two windings which are each associated with one another concentrically is arranged on the outside of a first mounting cylinder and the outer winding is arranged on the inside of a second mounting cylinder, with an annular gap being formed between the first mounting cylinder and the binding.

10. The transformer as claimed in claim 5, wherein the two windings have a first associated annular chamber on one end face, and have a second associated annular chamber on the other end face.

11. The transformer as claimed in claim 7, wherein the first annular chamber is connected to the coolant inlet.

12. The transformer as claimed in claim 7, wherein both annular chambers are provided with openings which lead into an intermediate space between the two windings.

13. The transformer as claimed in claim 7, wherein the second chamber is adjacent to the core and open towards the annular gap and towards the channels.

14. The transformer as claimed in claim 5, wherein in order to form the guide surfaces,

- two windings which are associated with one another concentrically are each arranged at a distance both from one another and from the core,
- the core, which is approximated in steps to a circular cross section, is provided with a binding in the area of the windings, forming channels,
- the inner of the two windings which are each associated with one another concentrically is arranged on the outside of a first mounting cylinder and the outer winding is arranged on the inside of a second mounting cylinder, with an annular gap being formed between the first mounting cylinder and the binding,
- the two windings have a first associated annular chamber on one end face, and have a second associated annular chamber on the other end face,

with

- the first annular chamber being connected to the coolant inlet,
- both annular chambers being provided with openings which lead into an intermediate space between the two windings,
- and the second chamber being adjacent to the core and being open towards the annular gap and towards the channels.

15. The transformer as claimed in claim 14, wherein rod-like spacers are arranged at locations where the core has chord-like discrepancies on a circular cross section in order to approximate the cross section of the core and the circumference of the binding.

16. The transformer as claimed in claim 14, wherein the second mounting cylinder is formed by a supporting binding.